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in solid and in gaseous species, upon which several chemists have in late years insisted.

The question of heterogeneous and of homogeneous differentiation or disintegration in gases is also discussed at length, as well as several other related problems, all of which have been previously noticed in the author's lately-published volume, entitled "A New Basis for Chemistry," to which the present paper is a supplement.—*T. Sterry Hunt.*

Miscellaneous.—By subjecting mixtures of zinc salts and sulphates of sodium or potassium to a high temperature Alex. Gorgeu[1] has succeeded in obtaining little hexagonal prisms and plates of zinc oxide with the hardness and density of the natural *zincite.* By the addition of a small quantity of manganese sulphate to the mixture before heating, the crystals obtained possessed the pink color of the natural mineral. *Willemite* was produced by calcining a mixture of one part zinc sulphate, one-half to one part sodium or potassium sulphate, and one-thirtieth part hydrated silica. The crystals obtained were in the form of hexagonal prisms, terminated by an obtuse rhombohedron. They corresponded in all their properties with the naturally-occurring willemite.——Bourgeois[2] has effected the syntheses of several crystallized carbonates by heating their corresponding amorphous carbonate precipitates to a temperature of 100° in glass tubes containing a solution of some ammoniacal salt. Calcium, strontium, and barium carbonates crystallized as *calcite, strontianite,* and *witherite.* The first was accompanied by some aragonite. Lead carbonate crystallized as cerussite and hydrocerussite, and cadmium carbonate formed little crystals corresponding to calcite. The same results were reached by heating solutions of the saline salts with ammonium carbonate at 140°.——Brazilian *topaz* possesses an electrical axis which does not correspond to any crystallographic axis.[3]——E. Cohen[4] has described pseudomorphs after the concretionary *markasite* occurring in the chalk at Rügen, Pomerania. The pseudomorphs are composed of a mixture of 9.88 per cent. silica, 11.93 per cent. copiapite, and 78.19 limonite.

BOTANY.[5]

Smut in Oats.—Some recent experiments made at the New York Agricultural Experiment Station upon the smut (*Ustilago segetum*) which affects the panicles of the oat are of such interest that we reproduce here the substance of the account found in the fifth annual report of the station.

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[1] Comptes Rendus, civ., 1887, p. 120; Bull. d. l. Soc. Chim. d. Paris, xlvii., Feb. 1887, p. 146.

[2] Ib., ciii., 1886, p. 1088; Bull. d. l. Soc. Chim d. Paris, xlvii., Jan. 1887, p. 81.

[3] K. Mack, Pogg. Annalen, 1886, No. 6, p. 153.

[4] Sitzb. d. Naturw. Ver. f. Neuvorpommern u. Rügen, 1886.

[5] Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

After repeated observations it was found that the loss by smut the past year in an oat-field upon the station was about eight and a half per cent. The question of the transmission of smut from crop to crop was taken up. Seed was procured from a very smutty field in another county and sown upon plats of ground variously situated. The results were as follows: Plat A, 28.81 per cent.; plat B, 30.86 per cent.; plat C, 11.68 per cent.; plat D, 21.49 per cent. The average for all was 23.21 per cent.

Ten other plats were sown with seed from the same field, but here the seed for each plat was treated with some substance supposed to be injurious to the spores of the smut. The results are given in the following table:

	Hours.	Per cent. of Smut.
Plat E soaked in copper sulphate solution	17½	1.78
" F " " " " "	40	0
" G " iron sulphate solution	17½	16.51
" H " " " "	40	12.15
" I " caustic potash "	17½	0
" J " sodium chloride "	17½	4.07
" K " potassic nitrate "	17½	10.21
" L " cattle-urine	24	3.47
" M " cattle-urine + quicklime	24	3.38
" N " castile soap + water and quicklime	24	2.25

Two of the applications, it will be noticed, proved to be efficacious remedies,—viz., the copper sulphate and the caustic potash. The solution of copper sulphate consisted of four ounces dissolved in one gallon of water. The caustic potash solution was made by dissolving half an ounce in one and a half pints of water. It is stated that the treatment of the grain with the various substances seemed to produce no injurious effect upon the plants.

Students as Collectors.—By the time this note comes to the readers of the NATURALIST hundreds of classes in botany will be engaged in collecting material for study and for making into specimens. The amount of material gathered from the forests and fields is no doubt enough each spring to make a pretty large herbarium. And yet, if all these dried plants were brought together, how few of them would be really desired by the professional botanists of the country! A few Ranunculaceæ; several Cruciferæ; a good many Leguminosæ and Rosaceæ; all the violets obtainable; an Umbellifer or two, rarely more; several of the Rubiaceæ; some early and easy Composites, and so on to the grasses and ferns, make up the collections. The fifty or one hundred species in each collection are those which the pupil finds to be the easiest to obtain and identify of all that come under his notice. The early sedges and grasses he passes by, for the most part, while the mosses and lichens, the toadstools, the puff-balls, the rusts, smuts, etc., are all ignored as much as if they belonged to an entirely different domain of nature.

Let the teacher make the experiment of encouraging the collection and study of all kinds of plants. Let him, when a pupil brings a certain flattish fungus with many pores on its under surface, take a couple of minutes to direct attention to the pores, on the walls of which the spores are developed; to the tough mass of closely-interwoven threads which makes up the body of the fungus; to the fact that the plant is a saprophyte; and, at last, let the pupil be told that botanists call it *Polyporus versicolor*, and consider it to be somewhat related to the toadstools. When a spotted strawberry-leaf is brought, let the teacher tell something about its cause, even if it be but little. Let him show the pupil by a rough sketch or two the general nature of the parasite. Let the pupil be told to look for similar spots on other plants, and let him know that the name now applied to the species on the strawberry-leaves is *Ramularia tulasnei*. Do so with lichens, with pond-scums, green slimes, with mosses, with liverworts,—in fact, with whatever is brought in by the sharp-eyed young collector.

But many a teacher will say that such work is impossible to any but a professional botanist with a perfect acquaintance with all the plants of the flora. It is not necessary, however, that full details should be given regarding any plant brought by the pupil. He must be a poor teacher indeed who cannot suggest something to his pupil about a toadstool or a puff-ball. It is not necessary to know the species or even the genus to which a plant has been assigned in order to be able to make valuable suggestions to one's pupils. No man should accept the responsibility of teaching botany who does not know something of all the grand divisions of the vegetable kingdom, and who is not able to render a little aid to the pupil in whatsoever botanical class his plants may fall.—*Charles E. Bessey.*

The Entomophthoreæ.—According to a note in the *Journal of the Royal Microscopical Society*, Dr. E. Eidam has recently made a revision of the Entomophthoreæ (in Cohn's "Beit. zur Biol. der Pflanzen," IV., 1886), and given diagnoses of the genera,—seven in all,—viz., Empusa, Lamia, Entomophthora, Tarichium, Completoria, Conidiobolus, and Basidiobolus. He places the family in the Zygomycetes, in close proximity to the Mucorini, tracing a relationship to the latter through Piptocephalis and Syncephalis.

Laboratory Notes.—The usefulness of a simple and inexpensive *eye-piece micrometer* as a part of the outfit of each microscope in the laboratory can scarcely be fully appreciated until one has tried it. When the student has at hand at all times a means for making accurate measurements he will make many more records of measurements than when he has to call upon the demonstrator for a special eye-piece. A simple graduated disk of glass which rests upon the diaphragm of the eye-piece is sufficient. It is, of course, best to have it in a second eye-piece, but in case the microscope has but one eye-piece the disk can be easily removed when not needed.

Cheap, and still efficient, *culture-cells* for the growth of spores, pollen, etc., may be made by the use of the little vulcanite rings now sold by all opticians. A ring is fastened to a slide by means of gold size; when dry and firm a little oil is spread upon the ring, and upon this the cover-glass (bearing the hanging-drop, in which are the spores) is carefully laid, care being taken to secure an air-tight chamber.

Very frequently a student wishes *to preserve a specimen temporarily*, when he is obliged to leave the laboratory before completing his work. This he can do with most specimens by simply applying a drop of glycerin at the side of the cover-glass in such a manner as to effect a union between the water and the glycerin. The latter will slowly run under the cover-glass and preserve the moisture of the specimen often for many days.

The *value of dried specimens* of algæ, such as the Green Felts (*Vaucheriaceæ*), the *Œdogonieæ*, the Red Seaweeds (*Florideæ*), Rockweeds (*Fucaceæ*), etc., is probably not fully appreciated by demonstrators in laboratories. The structure of the plants of the groups just named, as well as of many others, can be made out very satisfactorily from dried specimens. One is able to take up types of the more important families of plants in their proper order, and during those parts of the year when they are not to be obtained from the water. In most cases the specimen must be moistened with alcohol and, after mounting, with potassic hydrate also. Some of the most satisfactory specimens I have ever seen have been obtained in this way. Of course, one must have good material to begin with.

An *instructive specimen* for the student of the lower plants may be obtained by making as thin sections as possible of the soft lichens of the genera *Collema*, *Leptogium*, or their allies. Any one who has previously studied the Nostocs will recognize them at once in the lichen sections, where they occur as "gonidia." One can, in fact, make use of lichens of this kind for supplying with certainty good and abundant specimens of Nostoc when the Protophytes are under consideration in the laboratory.

One of the most *instructive series of experiments* as to the water in the plant which the student can undertake consists of weighing green specimens of various kinds, and then, after careful drying, repeating the weighing to determine the loss of water. This can be done very satisfactorily in the winter, when the air of the laboratory is constantly dry, and when the steam-radiators can be utilized for drying the specimens. While the results are not absolutely accurate, they are sufficiently so to teach very forcibly the lesson that all plants contain a great deal of water, and that many of them are almost entirely water.

Botanical News.—A new monthly periodical,—*Popular Gardening*,—which first made its appearance last year, promises to become of interest to botanists as well as gardeners. It is published in Buffalo, N. Y.——Rev. Francis Wolle, of Bethlehem, Pa., well known as a student of the fresh-water algæ and author of a most useful work on the "Desmids of the United States," is preparing a treatise on the Fresh-Water Algæ of North America. The work may be expected about the middle of the year. It will be illustrated by one hundred and fifty plates, containing two thousand figures. We trust that the enterprising author will be rewarded by an abundance of orders for the book, which necessarily must be somewhat expensive.——In the February number of the *Journal of Botany* Richard Spruce describes a new Hepatic (*Lejeunea holtii*) from Ireland, and J. G. Baker a new fern (*Polypodium microchasmium*) from Jamaica.——A recent number of the *Gardeners' Chronicle* (February 12) contains a fine "ink-photo." of a group of British Guiana palms (*Maximiliana regia*).——The following are among the botanical books announced for early publication: An elementary class-book of botany, by Dr. Gray, "to take the place," according to the *Botanical Gazette*, "of 'How Plants Grow' and the 'Lessons';" an introduction to the study of lichens, by Henry Willey, of New Bedford, Mass.,—according to the *Torrey Bulletin*, "it will include the collecting and mounting of lichens, their structure and organs, the distribution of North American species, the history of lichens, with aids to their study;" a treatise on the fresh-water algæ of North America, by Rev. Francis Wolle, of Bethlehem, Pa.,—this work, of which mention has already been made, will be fully illustrated with colored plates; a treatise on the natural families of plants ("*Die natürlichen Pflanzenfamilien*"), by Professors Engler and Prantl, to be illustrated by many thousand wood-cuts to illustrate the structure; the anatomy and classification of the Hymenomycetes of Europe (*Les Hyménomycètes d'Europe*), by N. Patouillard.——Among recently-published botanical books are the following: "Lectures on the Physiology of Plants," by Dr. S. H. Vines; "Outlines of Classification and Special Morphology of Plants," by Dr. K. Goebel; "Grasses of North America," by Dr. W. J. Beal; "Microbes, Ferments, and Moulds," by E. L. Trouessart; the new edition of Rabenhorst's "Kryptogamen Flora;" vol. i. "Pilze," by Dr. Winter; vol. ii. "Die Fampflanzen," by Dr. Luerssen; vol. iv. "Die Laubmorse," by Limpricht (these are appearing in parts, each containing sixty-four pages).——Valuable exsiccati now publishing are: Ellis & Everhart's "North American Fungi"; Linhart's "Ungarus Pilze"; "Der Belgischen Muscineen," by Aigret and François; Wittrock and Nordstedt's "Algæ Aquæ Dulcis Exsiccatæ"; Krieger's "Fungi Saxonici Exsiccati"; Winter's "Fungi Europæi et Extraeuropæi Exsiccati."——Recent catalogues of botanical works which will prove valuable to botanical book-buyers are as follows: "A Catalogue of Botanical Works," by Dulan & Co., 37 Soho Square, London; "Bulletin Trimestriel des Sciences Naturelles" of Paul Klincksieck, 15 Rue de Sèores, Paris; "Katalog No. 202," von Heinrich Lesser, of Breslau; "Verzeidenis von Werken aus dem Gesamtgebeite des Botanik," von List & Frank, Leipzig; Koehler's "Katalog No. 448" (Floræ, Anatomia et Physiologia Plantarum, Phanerogamæ, etc.) and No. 449 (Cryptogamæ), Leipzig.

ENTOMOLOGY.[1]

On the Emergence of a Caddice-Fly from the Water.—On one occasion I had the good fortune to observe a caddice-fly leave the water and take its first flight. The specimen was an *Hydropsyche*, which I was breeding in an aquarium in my laboratory. It swam to the surface of the water repeatedly, using its long mesothoracic legs. When swimming, these legs were extended at right angles to the body like a pair of oars. The insect was unable to crawl up the vertical side of the aquarium, and after clinging to it for a short time it would lose its hold and sink back to the bottom. After watching it for a time I lifted it from the water by means of a stick. At this time its wings were in the form of pads, which were but little, if any, longer than the wing-pads of the pupa, as shown by the cast pupa-skin found floating on the water. The instant the creature was free from the water its wings expanded to their full size, and immediately it flew away several feet. In my efforts to catch the insect I found that it had perfect use of its wings, although they were so recently expanded. The time required for the insect to expand its wings and take its first flight was scarcely more than one second; it was certainly less than two. As these insects normally emerge from rapidly-flowing streams which dash over rocks, it is evident that if much time were required for the wings to become fit for use, as is the case with most other insects, the wave succeeding that which swept them from the water would sweep them back again and destroy them.—*J. H. Comstock.*

Destruction of the Codlin-Moth by Arsenical Poisons.—In the first of a series of bulletins to be published by the State

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[1] This department is edited by Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.